

# Research Concepts: Implementation Version 2.0

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# Overview

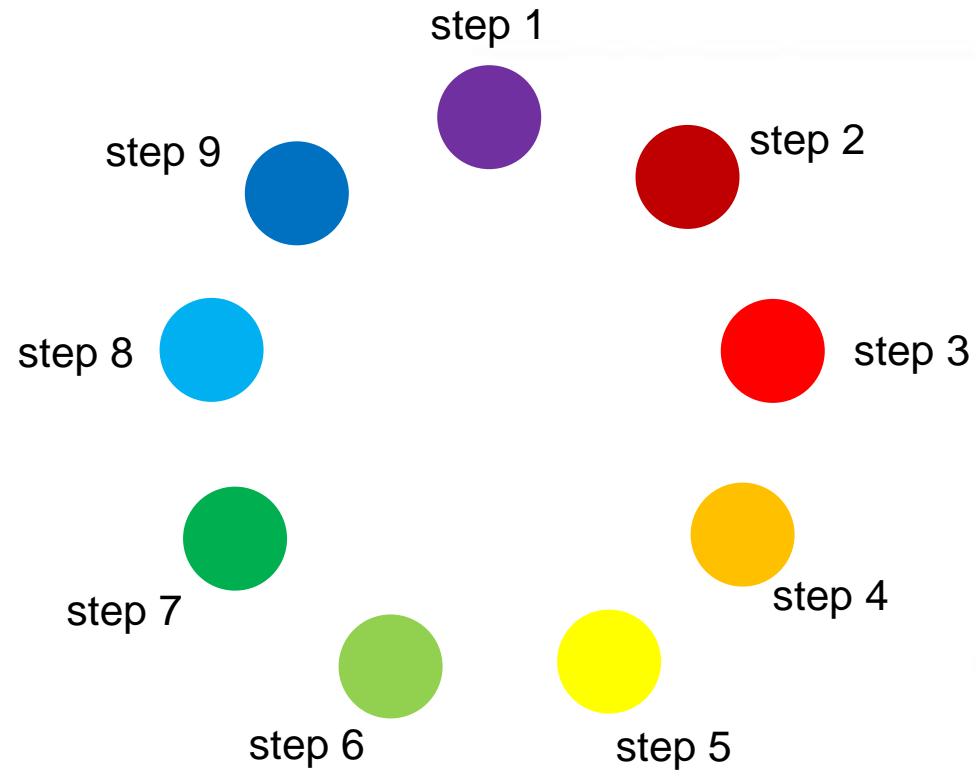


- Review Methodology
- Research Process
  - Review the nine steps
  - Example using a soil project
- **Remember it is about the PROCESS!**

# Research Process



- ✓ Originates with a question or problem.
- ✓ Requires clear articulation of a goal.
- ✓ Follows a specific plan or procedure.
- ✓ Often divides main problem into subproblems.
- ✓ Guided by specific problem, question, or hypothesis.
- ✓ Accepts certain critical assumptions.
- ✓ Requires collection and interpretation of data.
- ✓ Cyclical in nature.



# Step 2: Suggest Hypotheses



- The researcher generates intermediate hypotheses to describe a solution to the problem.
  - This is at best a temporary solution since there is as yet no evidence to support either the acceptance or rejection of these hypotheses.

## Example:

- **The hypothesis of this research is that increasing amounts of *residue* left on the land will result in delayed seedling emergence and reduced plant populations.**

# Step 4: Test Hypotheses



- Plan research
  - Determine variables
    - **Independent variable(s)** – represents the factors or conditions that will be manipulated or changed by the investigator in order to do an experiment.
    - **Dependent variable(s)** – is the observed result of the independent variable being manipulated - the dependent variable ***depends*** on the outcome of the independent variable.
  - Designing experimental procedure
    - This involves planning how the independent variable will be changed and how to measure the impact that this change has on the dependent variable.
  - Conduct Experiment

# Designing experimental procedure



- Soil Fertility Investigation
  - Nitrogen
  - Phosphorus
  - Potassium
- Potential crop choices:
  - **Tomato**
  - **Pepper**
  - Corn
  - Soybean
  - Wheat
- Goal one plant per pot for all plants except wheat, in this case strive for three.

# Designing experimental procedure (continued)



- **When planning consider space constraints!**
- When starting the experiment, germinate extra plants, just in case!
- Be careful using heating pads when germinating seeds so they don't dry out.
- **Water carefully!**
  - Not too much.
  - Not too little.

# Designing experimental procedure (continued)



- Depending on the crop and the length of the experiment at least one gallon pots will be necessary. Plants will need to be transplanted once maybe twice.
- Soil and Fertilizer requirements
  - Granular fertilizer
    - Urea (nitrogen)
    - TSP (triple super phosphate)
    - Potassium chloride (potassium)
- Soil or greenhouse potting media



# Know what you're starting with



		GPS	
Nitrogen	NO <sub>3</sub> -N (ppm)	88	
Phosphorus	P <sub>2</sub> O <sub>5</sub> -P (ppm)		
Bray1		36	
Olsen		30	
Potassium	K (ppm)	158	
pH		5.5	

# Designing experimental procedure (continued)



- Possible nutrient combinations:
  - N (P and/or K deficiency)
  - P (N and/or K deficiency)
  - K (N and/or P deficiency)

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  - NP (K deficiency)
  - NK (P deficiency)
  - PK (N deficiency)
  - NPK
  - Control (no fertilizer)
- Replications
  - Recommend three
    - For example, if there are six groups of three people, then each group could represent a replication (six reps) in order to reduce the number of experimental units to handle.

# Designing experimental procedure (continued)



- **Tomato and Pepper fertilizer guidelines:**
- A soil test is the most accurate guide to fertilizer requirements.
- Nitrogen: 100-150 lb N/acre.
- Sidedress with 35-50 lb N/acre after the first flowers are set.
- Phosphate: 100-150 ( $P_2O_5$ ) lb/acre
- Potash: 100-200 ( $K_2O$ ) lb/acre depending on soil test.
- pH: Add lime if below 6.0

# Step 4: Test Hypotheses (continued)



## Quantitative

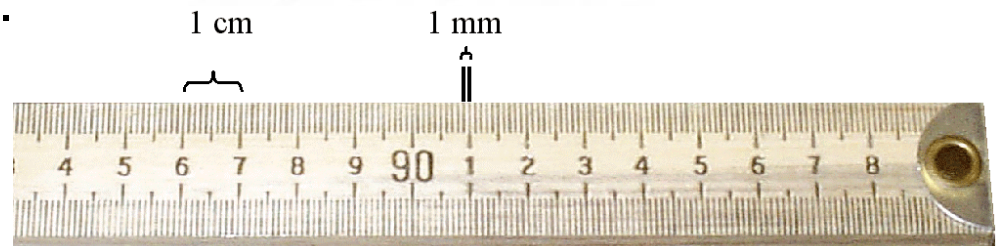
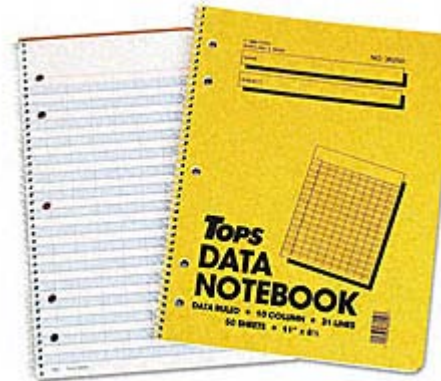
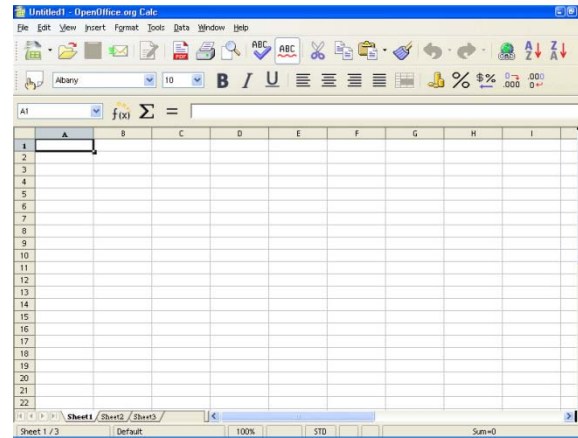
- Potential standardized measurements
  - Time (days) for seedlings to emerge
  - Number of seedlings emerged
  - Plant height (weekly)
  - Plant weight (end of project)
  - Time (days) to flowering
  - Yield (weight)

## Qualitative

- Potential observations
  - Nutrient deficiency symptoms
    - Description/Characterization
    - What part of the plant do they show up on first?

# Step 5: Acquire Data

- The researcher now begins to gather data relating to the research problem.
  - The means of data acquisition will often change based on the type of the research problem.
  - This might entail only data gathering, but it could also require the creation of new measurement instruments.





# THANK YOU!

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